By the close of the month the river at most points had receded to the low stages that prevailed previous to the rains and was either stationary or falling slowly from the mouth of the Pitt River to Collinsville.

Heavy rains in the headwaters of the Feather-Yuba from the 14th to 16th resulted in marked rises in all of the smaller streams throughout this territory, but, with the exception of the Yuba at Marysville, where there was a rise of slightly over 1 foot, little effect of the rains was noted in the main streams.

The American River averaged somewhat higher than during the preceding month.

San Joaquin watershed.—Rain fell generally throughout the drainage basin of the San Joaquin River from the 14th to 16th, and all the tributaries responded thereto. At most points the river, prior to the rains, reached the lowest levels ever recorded, notably, the Stanislaus at Melones, where it fell to over 4 feet below the zero gage, and where an average of nearly 4 feet below was maintained.

The San Joaquin itself responded quickly to the rainfall at all points along its course, with a rise of over 3 feet at Pollasky and Firebaugh, and of 2 feet at Lathrop, but it receded rapidly during the last decade of the month, and its general average was as low or lower than that of the month preceding.

EARLY RAIN AT FRESNO, CAL., IN SEPTEMBER.

By W. E. BONNETT, Local Forecaster.

No feature of the meteorological record for the month needs particular remark except the unusual rains of the 14th and 15th. The extremes of temperature, 102° on the 1st and 48° on the 13th, are well within the limits established from 23 years of record. The rains here mentioned are remarkable for their amount and for the early date upon which they occurred. A fall of 0.27 inch occurred during the forenoon of the 14th, this being greater than any shower to that date since the beginning of the Weather Bureau record at Fresno. A further fall of 0.73 inch occurred on the 15th, and the weather remained threatening during the 16th with a light shower in the early morning hours.

Warnings of rain were issued on the evening of the 13th, and the work of stacking the raisin trays went on in the vineyards during the entire night. Practically all picking had been done, but the work had been finished so recently before the rains that much labor imported into the vineyards for picking the crop was still available for the business of stacking trays. The inconvenience of night work can well be imagined and the difficulty of securing assistance for stacking in the nighttime hours is very great for those who do not have the necessary help permanently employed. The night of the 13th was partly cloudy to cloudy so that the moon, although nearly full, lent but feeble aid to the workers. Furthermore, the quantity of the product to be thus speedily handled was very great, and a part of the crop was found unprotected when the rains came. It is impossible even at the close of the month to obtain a fair estimate of the damage, but the loss will probably not be very great. In no case that has come to my notice has it been necessary to dispose of the raisin grapes, that were wet, to the wineries as sometimes happens. All will be saved as raisins. The damage consists in a somewhat poorer quality of the product, an inferiority due principally to a less salable appearance rather than to any real inferiority in quality. The fact that the rains were so early will probably account in great part for this comparatively small damage, as the raisins were in the earlier stages of the drying process, many not having been turned. However, the rains are having the important effect of prolonging the drying season and a great proportion of the crop remains on the trays at the close of the month. The ground was thoroughly wet and dew formed almost nightly, a meteorological phenomenon that is rare for September under normal conditions at this place. Drying, therefore, ceases during the night and it is proceeding slowly during the day under this condition of increased humidity. In a lengthened drying season, the cost of production may be greatly increased, owing to the possible need for repeated stacking and unstacking of the trays with the approach of the rainy season.

CONSERVATION OF THE PURITY OF THE AIR—PREVENTION OF SMOKE.

By ALEXANDER G. MCADIE.

Some interesting questions arise in connection with the present use (also the proposals to use on a much larger scale) of electrical agencies for smoke prevention in cities on the Pacific coast, and especially near San Francisco. In the July report of this section reference was made to the methods used for removing the poisonous gases in smelter fumes. The need in this case was urgent, and Doctor Cottrell and those working with him have made it possible for smelters to carry on work near a large city. The irritating gases, especially the sulphur and arsenic compounds, are deposited; but it is our understanding that the carbon products are allowed to pass out into the air.

Beyond the individual problem of protecting the community from the effect of smelter smoke, there looms the much greater problem of the general purification of the air near the ground. It comes home with force to every one who must live near an industrial center that a smokeless atmosphere is a great privilege. In some communities steps have been taken to bring this about, either by improving the methods of combustion or by the use of smoke filters.

Another important matter is that of producing and maintaining dust-free atmospheres where there is special need for the same, as in hospitals, schools, auditoriums, etc. Eventually we must deal with the problem of depositing, not only the dust and nuclei of condensation, but the condensed vapor in the air also. This will lead in time to problems connected with the dissipation of fog at terminal points or in harbors, and ultimately the problem of fog control may be attacked.

In California oil is coming into widespread use and one would naturally think that, with modern methods of combustion, there would be less smoke; but such is not found to be the case. Oil is now being used not only as fuel, but in the making of gas. There is some reason for believing that, with the introduction of certain improvements, gas-house chimneys, which have always been conspicuous offenders in the pollution of the air over cities, may cease to be such. That is to say, it is proposed to practically utilize the carbon recovered in the manufacture of gas from crude oil.

Where oil is used for fuel, the gas products are carbon dioxid, carbon monoxid, and nitrogen. The smoke particles are hydrocarbons, volatile at comparatively low temperatures. In most furnaces the flame is to some degree extinguished by impinging on a comparatively cold surface. The load of carbon dust therefore passes out unconsumed. In a properly-constructed furnace all the fuel should burn and nothing pass out as black smoke. The following paragraph from an editorial in the leading power journal of the Pacific coast is worth quoting in connection with the discussion to be given later, because it not only calls attention to the mischievous effects of imperfect combustion, but shows how the fuel bill can be reduced:

> Smoke is a nuisance in the eyes of the law and any reasonable ordinance intended for its abatement will be sustained by the courts. When the dirt that it creates and the discomfort that it causes become intolerable, the sufferers appeal to the lawyer for relief, and drastic legislation sometimes ensues. This may be obviated by a little care and foresight on the part of the stationary engineers, if they will but anticipate this inevitable effort for civic betterment, by drafting and urging reasonable legislation. In other words, they should not leave to lawyers and politicians the regulation and even operation of their power plants. * * * If half the time expended in trying to outwit the inspector were utilized in legitimate smoke prevention, the fuel bill at least would be the gainer.—*Journal of Electrical Power and Gas. Vol. 25, No. 2, page 34.*

Aside from the economy in the use of fuel there can be no questioning the right of a community to a bountiful supply of pure air. Dust-laden and foul atmospheres contribute more to the undoing of the public health than is generally recognized. Provided the air be pure, changes of temperature, humidity, and pressure are more readily borne, because one's vitality has not been persistently lessened. In an impure atmosphere, where the dust, vapor, and gas content is high men fail to show a high efficiency in their daily work.

The air of cities is nearly always laden with impurities. It was shown in Aitken's experiments that where the wind came from cities the number of foreign particles was greatly in excess of the number found in air coming from the mountains or from the sea. The following table, which may be found in an expanded form in Aitken's papers, tells an interesting story in a few words:

During rain, 32,000 dust particles per cubic centimeter.

During fair weather, 130,000 dust particles per cubic centimeter.

In a room, 1,860,000 dust particles per cubic centimeter.

In a room, near ceiling, 5,420,000 dust particles per cubic centimeter.

In Bunsen flame, 30,000,000 dust particles per cubic centimeter.

The last item is especially significant because in the modern city, with tall office buildings, many men are required to work on a level or slightly above the chimney tops of lower buildings. Even with a very perfect combustion there must still be an enormous output of dust particles. In the case of smoky chimneys or where the combustion is imperfect, as is too frequently the case, there is poured forth a volume of comparatively large masses or agglomerations of numerous smaller particles.

It is not easy to ascertain the degree of pollution caused by any one chimney stack or for that matter a collection of chimneys. The following illustration, however, gives some idea of the actual weight of the solid impurities set free in the atmosphere of a large city to the detriment of all who live in that city. The American consul at Leeds, Mr. B. F. Chase, calling the attention of American manufacturers to an opportunity for the introduction of mechanical stokers and smoke-consuming devices, states that the business portion of the city is in need of air purification. Tests[1] were made of all the rain falling from November, 1907, to October, 1908. It was found that solid impurities diminished rapidly from the center of the town outward. In the chief industrial center the amount was twenty times greater than at a point three miles northeast. About 300 tons of soot per square mile reached the ground in the business section. The average amount was 100 tons per square mile.

The center of the city received but 83 per cent as much bright sunlight as a place but 4 miles away. Where the impurities were 1,536 pounds per acre there was 40 per cent less light than where the impurities were 146 pounds.—*Monthly Consular and Trade Reports, 1910, p. 116.*

In the European and older American cities the fuel used is chiefly coal, but in many of our western cities, and particularly now in California cities on the central and southern coast, oil is the fuel most commonly used. There ought to be less pollution of the air than when coal is used, owing to the better combustion, but apparently this is not the fact for one can see vast volumes of black smoke pouring from chimneys in San Francisco and other cities where oil is used for fuel. In a discussion on "Possible Improvements in Steam Power Plant Economy," before the San Francisco section, Institute of American Engineers, June 25, 1910, one speaker (Mr. A. H. Halloran) in showing the need of economy in combustion, made the following statement:

From 90 to 95 per cent of the energy in coal is wasted. One-third goes up the chimney as smoke and one-half is lost in exhaust steam. It seems to me that if our engineers, and also legislators, devoted as much time to improving the economy of existing power sites as they now expend in attempting to withdraw water-power sites or coal and oil lands they would do more for posterity and ourselves, because posterity will blame us more for our wasteful use of power than praise us for conserving disuse.

In this discussion the queer point came out and was alluded to by several engineers, that there could be an excessive and wasteful use of air. As a rule, about 50 per cent excess air is considered good practise; but there are many establishments in which the ratio of air supplied to that required would run up to 3, i. e., 250 per cent more than required. This causes a loss of efficiency. Air being obtainable without cost and the supply limitless, it is only natural that there should be considerable carelessness shown in its use. If, as one of the speakers said, owners of power plants had to pay for the air used, as they do for other materials, scrutiny of the bills would soon lead to cautionary directions to engineers and firemen regarding wasteful use of air.

There is needed then, to conserve to the community its right to enjoy unpolluted air, radical improvement in the selection and preparation of fuel and in the methods of burning. At present both the combustion and the furnace control seem to be imperfect and our methods crude and wasteful. Too large a portion of the fuel now escapes in the form of smoke, a positive menace to health and a source of annoyance and loss.

[1]By professors of the University at Leeds.

FIG. 1.—Oil products of combustion—black.

FIG. 2.—Wood smoke and steam—white.